

FIRST LANGUAGE

VOLUME 28 - ISSUE 1 - NUMBER 04 - FEBRUARY 2008



Understanding the semantic functions of but in middle childhood: The role of text- and sentence-level comprehension abilities

Journal:	<i>First Language</i>
Manuscript ID	FLA-16-0021.R1
Manuscript Type:	Original Manuscript
Keywords:	Connectives, story grammar, reading comprehension, sentence comprehension, italian primary school children
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Running head: UNDERSTANDING THE SEMANTIC FUNCTIONS OF BUT

Understanding the semantic functions of *but* in middle childhood:

The role of text- and sentence-level comprehension abilities

For Peer Review

Abstract

We examined Italian 7- to 9-year-olds' understanding of the connective *but* when used to relate two events in sentences embedded in short stories. Performance was largely accounted for by the cognitive complexity of the sentence that included the connective and the salience of its meaning (confirmed in a second study with adults). Additional influences on children's performance were the category of the story in which the critical sentence was embedded and the child's text comprehension abilities. Further, by 9 years of age, performance resembled that of adults. These findings make an advance in explaining the role of information presented in a text at different levels and an individual's linguistic abilities in children's understanding of the connective *but* in stories and its development.

Key words

Connectives, story grammar, reading comprehension, sentence comprehension

Understanding the semantic functions of *but* in middle childhood:

The role of text- and sentence-level comprehension abilities

Connectives or conjunctions are cohesive devices that indicate the semantic relations between propositions, sentences and events in texts (Halliday & Hasan, 1976; Sanders & Noordman, 2002; see also van Silfhout, Evers-Vermeul, & Sanders, 2015). The present work examined Italian children's understanding of the adversative connective *ma (but)* when presented in stories. Specifically, we investigated how features of the text's micro- and macro-structure, together with children's linguistic abilities, influenced comprehension of *but*.

Developmental studies on the production and comprehension of connectives in different languages have consistently shown that adversative connectives are acquired after additive, causal and temporal connectives and that age differences in the comprehension of the semantic relation signalled by adversatives are evident in children attending primary school (Cain & Nash, 2011; Cain, Patson & Andrews, 2005; Crosson, Leseaux, & Martiniello, 2008; Rustioni & Lancaster, 1994; Spooren & Sanders, 2008). In addition, previous studies have shown that production or comprehension of *but* and other connectives is influenced by factors at the sentence- and text-level (i.e., text micro- and macro-structure; Cain & Nash, 2011; Cain et al., 2005; Carretti, Motta, & Re, 2016; Crosson & Leseaux, 2013; Levorato & Zammuner, 1985; Peterson, 1986; Tribushinina, Dubinkina, & Sanders, 2015; Vion & Colas, 2005). For instance, the

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9 recent work of Tribushinina and colleagues (2015; see also Mak, Tribushinina, Lomako,
10 Gagarina, Abrosova, & Sanders, in press) on Russian 7-year-olds showed that the
11 correct use of two quasi-synonymous connectives in a narrative task required both the
12 understanding of semantic relations between events at the text-level and the integration
13 of semantic and syntactic information of connectives at the sentence level.
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20 Based on such evidence, three critical factors were considered in this study with
21 primary school children: a) the semantic functions of *but* (i.e., influence of text micro-
22 structure); b) the relevance of the linguistic context, namely the story category in which
23 the adversative was embedded (i.e., influence of text macro-structure); and c) the child's
24 linguistic abilities at sentence- and text-level comprehension (i.e., influence of
25 comprehension at micro- and macro-structure level). The analysis of these factors
26 extends existing research by examining the semantic functions of *but* in children's story
27 production and the interaction between the use of connectives and children's broader
28 linguistic abilities. We discuss each factor of influence, in turn, below.
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40 In the next sections, we refer mainly to studies carried out on English-speaking
41 children and children speaking languages other than Italian (e.g., Dutch, French,
42 Russian). Our research study focuses on the Italian connective *ma*, which is the most
43 appropriate translation of the adversative connective *but* and expresses a similar range
44 of semantic functions of *but* (for a complete discussion see Peterson, 1986; see also
45 Levorato & Zammuner, 1985). Another possible but less appropriate translation for *but*
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9 is *però* that, however, is used less frequently than *ma* (Treccani.it) and almost always in
10 oral colloquial communication. To our knowledge, there is only one study that has
11 considered the understanding of *but* in Italian (see the study of Levorato & Zammuner,
12 1985, below). However, a widely used Italian standardized test *Prove di Valutazione*
13 *della Comprensione Linguistica* (Test for the Evaluation of Linguistic Comprehension;
14 Rustioni & Lancaster, 1994) provides data on the understanding of connectives between
15 3 and 8 years, and specifically data for *ma*, which is the only adversative connective
16 included in that test. These data show that approximately 60% of 5-year-olds have an
17 appropriate understanding of the connective *ma*, whilst a similar percentage of 4-year-
18 olds show an appropriate understanding of *and* and other temporal and causal
19 connectives.
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33 **The Semantic Functions of *but***

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35 The connective *but* can be used to express different semantic and pragmatic
36 functions (Peterson, 1986; for other categorizations see, for instance, Kail &
37 Weissenborn, 1984; Lakoff, 1971). We focus on the semantic functions, which have
38 been identified in children's discourse production and are typically analysed along two
39 dimensions. The first dimension is the type of intra-sentence semantic relation, namely
40 the relation between the clause that precedes and the one that follows the connective.
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42 The second is the explicitness (*vs* implicitness) of the relation between the two clauses
43 that is established by the connective.
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Considering the first dimension of intra-sentence relations, two different types of intra-sentence relation can be expressed: *semantic opposition*, in which *but* expresses a contrast between two states, events or attributes; and *violation of expectation*, where a contrast is expressed between the event expected on the basis of the clause preceding the connective and the event described in the clause following the connective.

Considering the second dimension, both semantic opposition and violation of expectation can be *explicit* when the semantic opposition and the violation of expectation are directly stated, or *implicit* when the semantic opposition and the violation of expectation can be understood based on an inference. Thus, according to the two dimensions, four semantic functions of *but* are possible: a) *explicit semantic opposition* (e.g., *Italian summers are warm, but English summers are cold*); b) *implicit semantic opposition* (e.g., *Emma had a lovely rosebush, but the sheep got into her garden*); c) *explicit violation of expectation* (e.g., *Tom ordered his beer twice, but it never came.*); d) *implicit violation of expectation* (e.g., *Sarah's flight was delayed, but there was a nice shop at the airport*).

Several studies showed that these four functions are understood and produced at different ages. According to Peterson (1986), who analysed the spontaneous discourse production of 3- to 9- year-olds, the most relevant difference concerns the dimension of “explicitness”. Peterson found that children used *but* in their spontaneous discourse mostly to signal explicit relations. Older children, however, used *but* more often than

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9 younger ones to denote implicit relations. Peterson attributes this difference to the fact
10 that implicit relations are cognitively more complex than explicit relations, which do not
11 have to be inferred. Other research on connectives also indicates that differences in
12 cognitive complexity may explain developmental differences in comprehension and
13 production (e.g., Spooren & Sanders, 2008; Tribushinina et al., 2015). Considering the
14 dimension “type of intra-sentence relation”, Peterson (1986) found that all age groups
15 tend to use *but* to express semantic oppositions more often than violations of
16 expectation and that use of both kinds of *but* increases with age.
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26 Peterson’s conclusions on the developmental trend for the dimension of
27 ‘explicitness’ are supported by the work of Kail and Weissenborn (1984). They
28 examined 7- to 9-year-olds’ understanding of the contrastive and substitutive functions
29 of *but*. For both functions, *but* conjoins two propositions in which the second one denies
30 to some extent the meaning of the first. The difference between the two is that the
31 denied element had to be inferred in the contrastive function, whilst it is explicitly
32 mentioned in the substitutive function. This difference corresponds to some extent to the
33 explicit vs. implicit dimension of Peterson’s classification and implies that the two
34 meanings differ for their cognitive complexity. Kail and Weissenborn (1984) found that
35 the level of complexity had an effect on the comprehension of the connective since the
36 contrastive function was understood at about 9 years of age whereas the substitutive
37 function was understood at about 7 years.
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To our knowledge, only the study of McClure and Geva (1983) has considered the dimension ‘type of intra-sentence relation’. This study was with children from fourth to eight grade (and adults), so older than those studied by either Peterson (1986) or Kail and Weissenborn (1984). McClure and Geva (1983) compared the understanding of two adversatives: *but*, which is a coordinating connective, and *although*, which is a subordinating connective. In their stimuli, both connectives conjoined two propositions where, contrary to the expectation created by one proposition, a second proposition was also true. This function corresponds to some extent to the violation of expectation in Peterson’s classification. Participants completed a sentence cloze-task to examine connective usage. The basic use of *but* and *although* to express a violation of expectation was mastered by children in the fourth grade (9 year-olds).

There are no recent studies of children’s comprehension of *but*. Research to date that has considered both dimensions of the semantic functions of *but* in the same group of children has focused on spontaneous discourse production, not comprehension. We sought to address this gap in knowledge and examined all four semantic functions of *but* to determine how they are understood in stories by 7- to 9- year-olds. A cloze-task was used and children’s selection of the target connective *but* was considered. Also an analysis of non-target answers was conducted to identify alternative choices made by the two age groups for each semantic function of *but*.

The Relevance of the Linguistic Context

Children's use of connectives is affected by the broad linguistic context, namely text macro-structure (e.g., Cain, 2003; Levorato & Zammuner, 1985; Vion & Colas, 2005). In the work of Cain (2003), children aged 6 to 8 years produced their own narratives from prompts. Stories with the most coherent event structures (i.e., stories including a causal sequence of events) contained a higher proportion of instances of *but* and *because*, compared to stories that lacked a coherent event sequence. The work of Vion and Colas (2005) analysed the use of temporal, causal and adversative connectives by 7- to 11-year-old French children, in a story telling task elicited by comic strips. These strips differed as to whether the event sequence was arbitrary or ordered, and also whether the thematic continuity was preserved or not. The ordered sequence condition facilitated the use of connectives and 7-year-olds rarely used the adversative connective *but* as violation of expectation or opposition, whilst 11-year-olds did.

In the study of Levorato and Zammuner (1985), the connective *but* (*ma*) was embedded in different categories of two stories (Stein & Glenn, 1979). The stories were made up of a setting and an episode, which comprised 5 categories: initiating event, internal response, attempt, consequence and conclusion. The authors read the stories to 7-, 10- and 13-year-olds who were invited to retell the stories. The category of the story affected recall of the connective *but* in each of the three age groups: more instances of *but* were recalled in the categories of the initiating event and attempt, whereas fewer

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9 instances of *but* were recalled in the category of internal response. These results
10 suggested that the structure of the story has an effect on the understanding of *but*. We
11 adapted Levorato and Zammuner's (1985) stories in order to include the four semantic
12 function of *but* and examine the effect of the category of the story on performance.
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17 **The Role of the Linguistic Abilities of the Child**

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20 Previous research has shown that 7- and 9-year-olds differ from each other and
21 also from adults in their comprehension of adversative connectives (*but, although*) in
22 sentences (Cain & Nash, 2011). In order to analyse these age-related differences more
23 deeply, researchers have examined the relation between children's ability to select
24 appropriate connectives and their linguistic abilities at specific levels of language
25 comprehension: word-, sentence- and text-level (e.g., Cain et al., 2005; see also Crosson
26 & Lesaux, 2013 for a study on readers from different languages). This work has
27 demonstrated differences between skilled and less-skilled comprehenders aged 7 to 9
28 years in their ability to select the appropriate connective to join two clauses of a
29 sentence when embedded in short stories. The groups were matched for word- and
30 sentence-level comprehension, suggesting that group differences in connective
31 comprehension reflected group differences in text-level comprehension. To extend such
32 findings, we examined how children's ability to understand sentences and texts was
33 related to their understanding of the four semantic functions of *but* described earlier.
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9 text-comprehension (Silva & Cain, 2015), this analysis could shed light on the relative
10 influence of sentence- and text-comprehension on the understanding of explicit and
11 implicit functions of *but*.
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14 15 **Study 1** 16

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18 The aim of Study 1 was to examine 7- and 9-year-olds' understanding of the
19 connective *but* when used in stories. This age range was chosen because previous
20 research suggests that it is characterized by relevant changes in the understanding and
21 production of *but*. We examined comprehension of *but* in each of the four semantic
22 functions identified by Peterson (1986), embedded in two stories. In order to analyse
23 how the semantic representation of the text might affect the use of the connective *but*,
24 each story was first read to the children who then completed the cloze task. Critically,
25 we tested for the effect of the type of intra-sentence semantic relation codified by *but*
26 and its explicitness (influence of text micro-structure) and the effect of story categories
27 (influence of macro-structure) on performance. Also, we analysed the prediction of
28 performance by independent measures of children's sentence- and text-comprehension
29 abilities (influence of comprehension at micro- and macro-structure level).
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44 For text-micro structure, better performance was expected for explicit than
45 implicit instances of *but* indicating an effect of cognitive complexity, and older children
46 were expected to outperform the younger ones, in particular for implicit instances of *but*
47 (e.g., Peterson, 1986; Spooren & Sanders, 2008; Tribushinina et al., 2015; Vion &
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Colas, 2005). We also hypothesized that the use of semantic opposition would be mastered earlier than the use of violation of expectation as an effect of type of intra-sentence relation (Peterson, 1986; see also Kail & Weissenborn, 1984). In terms of text macro-structure, we expected to find lower performance on the internal response category and higher performance on the initiating event and attempt category as an effect of story's structure (Cain, 2003; Levorato & Zammuner, 1985). Finally, we expected that performance would be related to children's text comprehension and that the latter exerted a relative major influence on the understanding of implicit than explicit functions of *but* (Cain et al., 2005).

Method

Participants. Participants were seventy-one children in the second and fourth year of primary school: 35 were in the second year of school (mean age = 7;3 years, *SD* = 4 months, range 6;8-7;8; 54% females; hereafter 7-year-olds) and 36 were in the fourth year of school (mean age = 9;3 years, *SD* = 5 months, range 8;8-9;8; 56% females; hereafter 9-year-olds). The children, who spoke Italian as their first language, attended schools located in the North-East of Italy and came from middle-class socio-economic catchment areas. According to their teachers, none of the children had cognitive impairments or learning difficulties and none had been referred to the National Health Services for treatment. Parental consent was obtained for each child.

Material and Procedure

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9 **Stories and cloze-task with the connective *but*.** Two stories 179 and 177 words
10 long with a story grammar structure (i.e., including a setting and an episode, see
11 Appendix A; Stein & Glenn, 1979) were used. The first story (*The Piano and the Star*)
12 was about a piano who falls in love with a star and the second (*The Play*) was about a
13 class who have to perform a play for their parents. Both stories were modified so that all
14 four uses of *but* were presented in the following categories of the episode: initiating
15 event, internal response, attempt, and consequence. Examples of the four uses of *but* in
16 the different categories of the first story are shown in Appendix A. The second author
17 independently evaluated whether the four types of *but* presented in the two stories
18 expressed the four semantic functions adequately. Minor changes were made to fit the
19 four semantic functions.
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33 Children were read the two stories and completed the cloze-task in class in a
34 single session lasting approximately 30 minutes. Half of the participants heard the story
35 of the piano first, and half heard the story of the play first. In the cloze-task, each story
36 was presented in a written form where *but* and 12 other functional and content words
37 were omitted (see Appendix A). At the bottom of the text, 20 words were provided to
38 use to fill in the blanks. The full list of 20 words provided as options in the first story is
39 shown in Appendix A. These words included the connectives *but* (target) and *and* (non-
40 target but plausible option for *but*). In addition, function words (i.e., articles and
41 prepositions) and content words (i.e., verbs and nouns) omitted in the stories and
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9 function and content words semantically similar to the original ones were also included
10 (non-target and not plausible options for *but*). Three function and content words were
11 used twice to fill in the blanks. After completing the cloze task, children answered two
12 written questions to assess understanding of the story (examples of the questions and
13 possible answers are shown in Appendix B). One question required recall of literal
14 information (e.g., information that the fairy helped the piano to make peace with the star
15 is explicitly reported in the story) and the other required an inference to be generated
16 (the fact that the star become angry with the piano and why it did happen is not
17 mentioned in the story). Thus, the reader had to use his/her world knowledge to infer
18 this information.
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31 Performance was scored for the proportion of target answers for each of the four
32 semantic uses of *but* over the two stories and also the proportion of target answers for
33 each story category over the two stories. The internal consistency of the task was .83
34 (Cronbach's alpha on proportion of target answers for each of the four semantic uses of
35 *but*). The proportion of non-target responses, substitutions with the connective *and*,
36 substitutions with other functional or content words¹ or omissions was also calculated.
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38 Finally, the mean number of correct answers for the literal and inferential
39 comprehension questions over the two stories was computed. Answers to literal and
40 inferential questions were scored by two Italian postgraduate student assistants who
41 were trained in the coding procedure by the first author. Each assistant scored
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9 approximately 50% of the questions of each story independently and together resolved
10 uncertainties. All answers were also scored independently by the first author. A Cohen κ
11 value was calculated for literal and inferential scores in each story to evaluate interrater
12 reliability: the Cohen κ for the literal scores of the first and second story were 1.00 and
13 0.66 (mean .83) and for the inferential scores of the first and second story were .97 and
14 .87 (mean .92). The values indicate good to excellent interrater reliability.
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22 **Sentence comprehension.** The Italian version of the Test for Reception of
23 Grammar (Bishop, 1982) from the BVN 5-11 was administered (Bisiacchi, Cendron,
24 Gugliotta, Tressoldi & Vio, 2005). The test has 18 items that evaluate sentence
25 comprehension. The sentences contain salient morphosyntactic cues, such as gender and
26 number agreement, adversatives, negation and different types of phrasal structures (i.e.,
27 relative, passive). The test was individually presented to each child in a single session
28 lasting approximately 20 minutes. Children were required to choose which picture from
29 a set of four correctly represented the sentence spoken by the experimenter. The total
30 raw score was the number of correct answers (0 to 18). The internal consistency of the
31 test according to the manual is 0.68 (test-retest reliability).
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44 **Text comprehension.** Reading text comprehension was evaluated using the MT
45 test, validated on Italian school-age children ($n = 5700$) sampled in different areas of
46 Italy (Cornoldi & Colpo, 2011). The texts suitable for children in second and fourth
47 year were read in class in a single session lasting approximately 30 minutes. Each
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9 participant read a story followed by either 12 (7 year-olds) or 14 (9 year-olds) multiple-
10 choice questions, which were answered by choosing one out of four alternatives. The
11 comprehension questions concerned information that was either explicitly stated or
12 implied by the text. There was no time limit and children were allowed to return to the
13 text while answering questions, in order to minimize the memory load. The score was
14 the percentage of correct answers. For descriptive purposes, children's performance was
15 classified into four levels (from below average to very good level). The internal
16 consistency of the task is 0.68 (Cronbach's alpha).
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26 **Word reading fluency (control variable).** The word reading test from the
27 *Batteria per la valutazione della dislessia e della disortografia evolutiva* [Test Battery
28 for the Evaluation of Developmental Dyslexia and Dysorthography] (Sartori, Job, &
29 Tressoldi, 2007) was used. The test battery, standardised on 1550 Italian-speaking
30 children, was individually presented to each child in a single session lasting
31 approximately 10 minutes. Children read 112 words as fast as they could and without
32 errors. The words were bi-, tri-, and quadrisyllabic items which differed in frequency
33 and concreteness (ranging from high to moderately low). All items had a regular
34 pronunciation. Word reading accuracy (number of errors/ number of items) and fluency
35 (reading time in seconds/number of items) were computed. In the regression analyses
36 that follow, word reading fluency was considered as a control variable because: (a) the
37 cloze-task was presented in a written form and (b) word reading fluency is the critical
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variable for children learning to read in a transparent orthography and for the school years considered (Wimmer, Mayringer, & Landerl, 1998). The internal consistency of the task reported in the manual is .79 (test-retest reliability).

Results

Comprehension of stories. The mean score for the literal questions was at ceiling ($M = 0.99$, $SD = 0.08$ for each age-group) and the mean score for the inference questions was also high ($M = 0.74$, $SD = 0.31$ and $M = 0.75$, $SD = 0.28$, for 7 and 9 year-olds respectively). Thus, we can be confident that children read the stories for comprehension.

TABLE 1 ABOUT HERE

Cloze-task: influence of text-micro structure. Table 1 reports the proportion of target and non-target answers (and standard deviations) for each semantic use of *but* for the two ages separately. Overall, children performed highly and performance of the 9-year-olds was at ceiling for the explicit violations of expectation. Values of skewness and kurtosis were all within acceptable limits (all below .2) for this variable. Inspection of the data did not reveal multiple outliers.

A mixed ANOVA on the proportion of target answers was carried out. There were two within-participants factors: Type of intra-sentence relation (semantic opposition, violation of expectation) and Explicitness (explicit, implicit), and one between-participants factor: Age (7- and 9-year-olds). Partial eta squared (η^2_p) is reported as the

measure of effect size for all significant effects and interactions. In addition, significant interactions were explored with paired comparisons with Bonferroni's correction for multiple comparisons.

All three main effects were significant: type of intra-sentence relation ($F(1,69) = 97.65, p < .001, \eta^2_p = .59$), explicitness ($F(1,69) = 7.90, p = .01, \eta^2_p = .10$), and age ($F(1,69) = 15.12, p < .001, \eta^2_p = .18$). There were two significant two-way interactions: one between explicitness and age ($F(1,69) = 5.68, p = .02, \eta^2_p = .08$) and one between explicitness and type of intra-sentence relation ($F(1,69) = 50.88, p < .001, \eta^2_p = .42$). No other interactions reached statistical significance (all $F_s < 2.77$, all $p_s > .10$).

The interaction between explicitness and age arose because the difference between the older and younger children was higher for implicit (more cognitively complex) uses of *but* than explicit (less cognitively complex) uses of *but* (Implicit $M_s = .91$ and $.71$, and Explicit $M_s = .70$ and $.82$, for the older and younger groups respectively, both $p_s < .001$). The interaction between explicitness and type of intra-sentence relation reflects the fact that children were more accurate on implicit than explicit uses of *but* for semantic oppositions ($M_s = .78$ and $.61, p < .001$), but showed the opposite relation for violations of expectation with higher performance for explicit than for implicit uses ($M_s = .91$ and $.84, p < .001$). This interaction is more difficult to explain and we return to this in the Discussion.

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9 Table 1 reports the proportions of substitutions with *and*, substitutions with other
10 content/function words, and omissions. In the analysis of non-target answers we focused
11 on substitutions with *and* because it was the most frequent type of substitution.
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15 Instances of the other types of non-target answers were very low.
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18 A mixed ANOVA with the proportion of substitutions with *and* as the dependent
19 variable and the same three factors as above was carried out. The three main effects
20 were significant: type of intra-sentence relation ($F(1,69) = 82.06, p < .001, \eta^2_p = .54$),
21 explicitness ($F(1,69) = 16.23, p < .001, \eta^2_p = .19$), and age ($F(1,69) = 8.71, p < .001, \eta^2_p$
22 = .11). Moreover, the two same two-way interactions were significant: explicitness and
23 age ($F(1,69) = 4.53, p = .04, \eta^2_p = .06$), and explicitness and type of intra-sentence
24 relation ($F(1,69) = 32.13, p < .001, \eta^2_p = .32$). No other interactions were significant (all
25 F s < 2.05 , all p s $> .15$).
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35 The interaction between explicitness and age arose because older children made
36 fewer substitutions with *and* than younger children when *but* expressed implicit
37 relations (M s = .17 and .06, for the older and younger children respectively, $p = .001$),
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39 whereas the two age groups did not differ when *but* expressed explicit relations (M s =
40 .20 and .17, $p = .23$). The interaction between explicitness and type of intra-sentence
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60 relation arose because the number of substitutions with *and* was higher for explicit than
for implicit semantic opposition (M s = .32 and .15, $p < .001$), whilst no difference was

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detected between explicit and implicit violation of expectation ($M_s = .05$ and $.08$, $p = .09$).

In sum, a similar pattern of results was obtained for target answers and substitutions with *and* in the cloze-task: when the percentage of target answers was smaller, the percentage of substitutions with *and* was higher, showing that an adversative conjunction is encoded as an additive one mostly by younger children and when a semantic opposition is expressed explicitly.

TABLE 2 ABOUT HERE

Cloze-task: influence of text macro-structure. Table 2 reports the proportion of target answers (and standard deviations) for each category of the story and the two ages. A mixed ANOVA on proportion of target answers was carried out. There was one within-participant factor, category of story grammar (initiating event, internal response, attempts, consequences) and one between-participant factor, age (7- and 9-year-olds). Both main effects were significant: category of story grammar ($F(3,207) = 15.18$, $p < .001$, $\eta^2_p = .18$) and age ($F(1,69) = 14.67$, $p < .001$, $\eta^2_p = .18$). These main effects were qualified by a significant interaction ($F(3,207) = 3.63$, $p = .01$, $\eta^2_p = .05$).

The interaction arose because: a) younger children gave a higher proportion of target answers in an initiating event than in a consequence ($M_s = .84$ and $.69$, $p = .003$), in contrast, the difference was not significant for older children ($M_s = .94$ and $.91$, $p = 1.00$); b) younger children gave a higher proportion of target answers in an attempt than

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9 an internal response ($M_s = .71$ and $.60$, $p = .04$), in contrast, the difference was not
10 significant for older children ($M_s = .79$ and $.83$, $p = 1.00$); c) older children gave a
11 higher proportion of target answers in a consequence than an attempt ($M_s = .91$ and $.79$,
12 $p = .04$), in contrast, the difference was not significant for younger children ($M_s = .69$
13 and $.71$, $p = 1.00$). In sum, these results suggest that more instances of *but* were
14 understood in an initiating event, by both groups, and in a consequence, by older
15 children.

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24 **Influence of comprehension at micro- and macro-structure level.** Table 3
25 reports means (and standard deviations) on the measures of sentence comprehension,
26 text comprehension and word fluency. Performance on the sentence comprehension and
27 word fluency tasks was appropriate (within one standard deviation of the norm) for age
28 and year of schooling, respectively. According to the norms of the text comprehension
29 test, 91% and 86% of the children aged 7 and 9 years, respectively, showed average or
30 good/very good levels of text comprehension. All others performed below average
31 levels, but within the norm for their year of schooling.

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42 TABLE 3 ABOUT HERE

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44 A set of analyses was conducted to examine the relations between the proportion
45 of target answers for each semantic use of *but*, and text and sentence comprehension
46 and word fluency. The correlations between variables are shown in Table 4. The pattern
47 of correlations was different for the two age groups. For 7-year-olds, significant
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9 correlations were found both within the four uses of *but* and also between performance
10 on each use of *but* and children's linguistic comprehension, in particular their text
11 comprehension. For 9-year-olds, the only significant correlation was between the two
12 types of *but* that expressed implicit semantic relations. Word reading fluency was
13 correlated neither with performance on the cloze-task nor with other measures of
14 children's linguistic ability for either age group.
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22 TABLE 4 ABOUT HERE
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24 A set of fixed-order hierarchical multiple regression analyses were carried out to
25 identify the relative contribution of sentence and text comprehension on the four uses of
26 *but*. These analyses were conducted on the whole group of children and the role of age
27 (0 = 7-year-olds; 1 = 9-year-olds) as well as the interactions between age, and sentence
28 and text comprehension were considered. The dependent variable was the proportion of
29 target answers for each of the four semantic uses of *but*. Age and word reading fluency
30 were entered as controls at Step 1 and 2, sentence and text comprehension were entered
31 at Steps 2 and 3 respectively. In the fifth step, interactions between age and sentence
32 comprehension and age and text comprehension were entered in order to identify any
33 possible moderation effect on the four uses of *but*. In order to control for
34 multicollinearity and to facilitate the interpretation of the results, the variables sentence
35 and text comprehension were standardized ($M = 0$, $SD = 1$) and z scores were used to
36 calculate the interaction terms (Aiken & West, 1991).
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The interaction between age and sentence comprehension did not explain a significant amount of variance ($ps > .09$) in any of the four models tested: Age did not operate as a moderator in the relation between sentence comprehension and the four uses of *but*, which was the same for 7- and 9-year-olds. Consequently, we tested more parsimonious models in which this interaction was excluded. The results for the final four models are presented in Table 5.

Overall, between 24-52% of variance for the four uses of *but* was explained. The pattern of results in the final step was similar for each of the four models: age and text comprehension were significant predictors of performance for the four dependent variables and these effects were qualified by a significant and negative interaction between age and text comprehension. These results show that text comprehension uniquely accounted for each use of *but* for 7-year-olds. In most cases, except for explicit violation of expectation, sentence comprehension did not explain a significant and unique amount of variance.

TABLE 5 ABOUT HERE

Discussion

We found that the adversative connective *but* was used effectively to express a range of semantic functions and that a significant change in competence was evident between 7 to 9 years of age. As expected, 9-year-olds demonstrated a robust

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9 understanding of the semantic functions of *but* when presented in short story contexts:
10 they gave very few non-target answers and, when they did so (for explicit semantic
11 opposition), their answers made sense in that they used the connective *and* instead of
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15 *but*.

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17 Both groups were not always poorer in implicit compared with explicit uses of
18 *but*. Contrary to expectations, the predicted pattern was found for violations of
19 expectation but not for semantic oppositions. Thus cognitive complexity of the
20 expression is not the sole factor influencing performance in this age range. First of all, it
21 should be noted that children tend to readily use *and* to mark a semantic relation
22 between events, even when a more specific connective, such as an adversative
23 connective, could be used (Peterson & McCabe, 1987; see also Spooren, 1997). This
24 finding, however, cannot fully explain the tendency identified in the present study to use
25 *and* mainly to signal explicit semantic oppositions. Second, a possible explanation is
26 that the unexpected pattern arises because of the relevance or the salience of the
27 connective *but* when it expresses an explicit semantic opposition. Our hypothesis is that
28 children used *and* instead of *but* to denote explicit semantic oppositions because the
29 adversative connective was not as critical for story comprehension in such instances as
30 for violations of expectation. In other words, when two states, events or attributes are
31 explicitly compared, the semantic opposition is not as salient as it is in the other uses of
32 *but*. For instance, the comparison ‘..*beautiful but easy*..’ is perceived as informative as
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'..beautiful **and** easy'. On the other hand, in the sentence '*The piano started crying **but** the star was too bad*', *but* cannot be substituted with *and* without changing the meaning of the sentence. Our explanation is in line with the work of Levorato and Zammuner (1985) who, in an extension of their main study, noticed that children did not reproduce the connective *but* for explicit semantic oppositions because information was partly transformed by the children when they recalled the story. In order to evaluate the post-hoc hypothesis of a salience effect in the understanding of explicit semantic opposition, we carried out a second study with adults.

Study 2

Study 2 was devised to determine if children's tendency to use *and* instead of *but* to codify explicit semantic oppositions can be explained by considering the salience of this use of *but*. According to the salience hypothesis, *and* might be used instead of *but* to codify the explicit semantic opposition between states, events or features because the contrast is not salient as it is in the other uses of *but*. Support for the salience hypothesis would be found if adults show the same pattern of performance as the children in Study 1.

In Study 2, university students were given the cloze passages used in Study 1 and were instructed to fill in the blanks with either *but* or *and*. We provided only two response options because the aim was to compare the use of these two specific connectives in the case of explicit semantic oppositions and in the other semantic

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9 functions of *but*. This change in methodology is explained further in the Method
10 section.
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12 13 **Method**

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15 **Participants.** Twenty-four undergraduate and postgraduate students participated
16 (mean age = 21 years, $SD = 2$ years, range 19-26; 62% females). The students, who
17 spoke Italian as their first language, attended degree courses in psychology (45%),
18 speech therapy (38%) and engineering (17%) in the North-East of Italy. Consent was
19 obtained from the individual adult participants.
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26 **Material and procedure.** Participants were presented with the same two cloze-
27 tasks used in Study 1 with the difference that only instances of *but* were deleted from
28 the stories and that the stories were not read out to them in order to minimise ceiling
29 effects. Students were asked to read the stories and to fill in the blanks with either the
30 connective *but* or *and*. We provided only these two options because we wanted the
31 students to make a choice between an adversative or an additive connective. To test our
32 specific hypothesis, we did not ask students to provide spontaneously a connective to
33 fill in the blanks in order to avoid more sophisticated answers incomparable with those
34 provided by children. The proportion of insertions with the connective *and* was
35 computed for each of the four uses of *but* and summed over the two stories. The internal
36 consistency of the task was .63 (Cronbach's alpha).
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50 51 **Results**

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Table 6 reports the proportion of insertions with the connective *and* (and standard deviations) on the cloze-task. Values of skewness and kurtosis were adequate and data inspection revealed no outliers. A repeated measures ANOVA was conducted with the proportion of *and* as the dependent variable and two within-participant factors: type of intra-sentence relation (semantic opposition, violation of expectation) and explicitness (explicit, implicit). The two main effects were significant: type of intra-sentence relation ($F(1,23) = 54.66, p < .001, \eta^2_p = .70$) and explicitness ($F(1,23) = 34.80, p < .001, \eta^2_p = .60$). These were qualified by a significant two-way interaction ($F(1,23) = 20.35, p < .001, \eta^2_p = .47$), following the same pattern as that found in Study 1. There was a higher proportion of instances of *and* for explicit than for implicit semantic oppositions ($M_s = .50$ and $.19, p < .001$) but no difference between explicit and implicit violations of expectations ($M_s = .10$ and $.04, p = .16$). Thus, when explicit semantic oppositions were considered, university students used *and* instead of *but* in 50% of the cases. Further, inspection of individual data showed that only 5 students out of 24 choose *and* in one case or never while 18 out of 24 chosen it two or three times.

TABLE 6 ABOUT HERE

Discussion

Adults' performance indicated that they considered both connectives (*and, but*) appropriate to join clauses that expressed an explicit semantic opposition, whereas *and* was considered less appropriate than *but* for other constructions. These findings

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9 provides evidence that adults, who are expected to have acquired a sophisticated use of
10 *but* (Cain & Nash, 2011; McClure & Geva, 1983), perceive the contrast expressed by
11 *but* in constructions that express an explicit semantic opposition as less salient or
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16 informative than in the other constructions.

17 18 **General Discussion**

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20 These two studies advance our understanding of how textual and individual factors
21 underlie a complex and nuanced linguistic phenomena: the understanding of the
22 semantic functions of *but* in stories and its development. Key influences on performance
23 for children are the cognitive difficulty involved in encoding the intra-sentence semantic
24 relation expressed by *but*, the relevance of information presented in the different parts of
25 stories, and also the children's linguistic abilities, in particular their level of text
26 comprehension. Our findings support previous research on children's understanding and
27 use of the connective *but* (e.g., Cain et al., 2005; Levorato & Zammuner, 1985) and
28 extend this by analysing performance at the micro- and macro-structural levels. We
29 discuss these findings and their implications, before outlining key issues for future
30 research.
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44 When we compare the performance of children (Study 1) with that of adults (Study
45 2) we see that 9-year-olds show appropriate understanding of the semantic functions of
46 *but* in stories whether expressed implicitly or explicitly. Children's tendency to
47 substitute *and* in the sentences that expressed explicit semantic opposition is indeed
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9 appropriate and is not a result of developmental differences: this pattern was found for
10 all age groups including adults. The reasons for such a salience effect, however, are not
11 clear and should be considered in future studies in which performance of both children
12 and adults will be compared directly. In addition, the contraposition between attributes
13 expressed by explicit semantic opposition are common and frequently found in Italian,
14 at least in oral conversations. Future research should therefore consider and compare the
15 comprehension and production of such constructions in narratives, in order to clarify
16 why adults and children in the current studies treated these constructions differently.
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26 We found that children's correct selection of *but* was influenced by the macro-
27 structure of the story: overall, performance was most accurate for sentences that
28 occurred in an initiating events but there were differences between age groups mainly
29 for sentences that occurred in a consequence. These results are in line with research on
30 story grammar that demonstrated a) children's better understanding of information
31 presented in initiating events and consequences than information presented in other
32 categories, because initiating events and consequences describe concrete events and, b)
33 found developmental differences in children's sensitivity to particular categories (Stein
34 & Glenn, 1979). Future research, thus, should extend this study to confirm that children
35 pay particular attention to critical contrasts expressed as oppositions and violations, at
36 different points in a story.
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For the younger children, at least, the understanding of *but* was related to independent measures of comprehension at the sentence- and text-level. Indeed, the influence of text comprehension was evident over and above levels of sentence comprehension for both explicit and implicit functions of *but*. These results are in line with findings of Florit, Roch and Levorato (2011; 2013) who found that the comprehension of sentences in isolation or in texts involve partly different processes and that constructive and integrative processes involved in text comprehension play a critical role in the understanding of both explicit and implicit information in texts. The relation between the comprehension at the text-level and comprehension of connectives extends the results obtained for listening comprehension and selected groups of children (Cain et al., 2005). Also, in line with findings of Cain and collaborators (Cain et al., 2005), sentence-comprehension and, to a large extent, word reading have weak effects on comprehension of connectives. Although a written cloze-task was used in the present study, the understanding of *but* in texts was not affected by the encoding of orthographic information but rather by skills that allowed semantic information to be accessed and understood. Interestingly, word reading and reading comprehension were unrelated, which may be a feature of the transparency of the Italian orthography (Florit & Cain, 2011). Critically, our finding of a stronger influence of text-level than sentence-level comprehension is in line with research proposing a primary role for connectives as markers of text-level coherence (e.g., Graesser, McNamara, & Louwerse, 2003; Sanders

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9 & Noordman, 2000). This study has shown, for the first time, a unique contribution of
10 text-level comprehension to each of the four different semantic uses of *but* in unselected
11 groups of children.
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15 We note the most significant limitations of this work and how they should be
16 addressed in future research. Clearly, there was a ceiling effect for the 9-year-olds,
17 which may have been due, in part, to our choice for a single alternative connective *and*
18 so that we could control for other confounds related to the use of other distractors. As a
19 result of this ceiling effect, it was not possible to determine fully how other language
20 variables influenced performance. In addition, the reliability of some measures devised
21 for the present study (i.e., the close-task for adults) were lower than desirable, although
22 they were all within the acceptable range for measures developed and used for research
23 purposes (Nunnally, 1978). Future work should include a bigger set of materials and
24 additional connectives as distractors to replicate the main findings and enable
25 examination of the influence of sentence- and text-level language abilities on
26 comprehension of *but* in older children. Such work might usefully include a focus on
27 syntactic complexity or structure and how that influences connective use; our study
28 focused purely on semantic uses of *but*. Timed measures would be an additional way to
29 increase task sensitivity for older children, where quicker performance would be taken
30 as an indicator of greater competence. Finally, future work should examine
31 comprehension of *but* in expository texts, which can follow a greater range of structures
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9 than the narratives used in the current study and have a greater reliance on accurate
10 understanding of connectives for comprehension of relations within the text.
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13 In sum, the present work has demonstrated that children's understanding of *but*,
14 when it is used to express different semantic relations, is affected by the specific type of
15 relation between two clauses, where in the story the sentence is located, and the child's
16 language comprehension skills, particularly their text-level comprehension. Our
17 findings support the call for further research to examine the factors influencing the
18 function of connectives in text-level comprehension and in conversational contexts and
19 to consider how best to teach the uses of *but* in educational texts and instructions (e.g.
20 Cain & Nash, 2011; Crosson & Leseaux, 2013).
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Note

¹ This category included functional or content words provided in the list or spontaneously given by the children. A single category was created because instances of these error types were very rare. Words provided by the children mainly included prepositions.

For Peer Review

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For Peer Review

Table 1

Mean Proportion of Target and Non-target Answers (and SDs) for the Cloze Task chosen by 7- and 9-year-olds

	7 year-olds			9 year-olds		
Proportion of target answers						
Explicit semantic opposition	.56 (.27)			.66 (.19)		
Implicit semantic opposition	.66 (.32)			.90 (.16)		
Explicit violation of expectation	.84 (.24)			.99 (.04)		
Implicit violation of expectation	.76 (.26)			.93 (.13)		
Proportion of non-target answers by type						
	S_and	S_other	Omis.	S_and	S_other	Omis.
Explicit semantic opposition	.32 (.20)	.10 (.18)	.02 (.09)	.33 (.19)	.01 (.06)	.00 (.00)
Implicit semantic opposition	.20 (.24)	.10 (.16)	.04 (.11)	.10 (.16)	.00 (.00)	.00 (.00)
Explicit violation of expectation	.09 (.15)	.06 (.12)	.01 (.06)	.01 (.04)	.00 (.00)	.00 (.00)
Implicit violation of expectation	.14 (.16)	.09 (.17)	.01 (.08)	.02 (.07)	.05 (.10)	.00 (.00)

S_and: substitutions with and; *S_other*: substitution with other functional or content words; *Omis*: Omissions

Table 2

*Mean Proportion of Target Answers (and SDs) for the Four Story Grammar Categories
Produced by 7- and 9-year-olds*

	7-year-olds	9-year-olds
Initiating Event	.84 (.23)	.94 (.15)
Internal response	.60 (.35)	.83 (.16)
Attempts	.71 (.24)	.79 (.11)
Consequences	.69 (.30)	.91 (.19)

Table 3

Mean Correct Answers (SDs) on Measures of Sentence Comprehension, Reading Comprehension and Word Fluency for 7- and 9-year-olds

	7-year-olds	9-year-olds
Sentence comprehension (total correct, max = 18)	15.63 (0.21)	16.14 (0.20)
Reading comprehension (proportion correct, max = 1)	0.78 (0.03)	0.74 (0.02)
Word fluency (total time/number of words)	2.17 (0.16)	0.94 (0.05)

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Table 4

Correlations Between Tasks for 7- and 9-year-olds (Upper and Lower Diagonal Respectively)

	1	2	3	4	5	6	7
1. Explicit semantic opposition	–	.65*	.56*	.54*	.29	.52*	.08
2. Implicit semantic opposition	.21	–	.72*	.60*	.44*	.59*	-.00
3. Explicit violation of expectation	.14	.15	–	.74*	.48*	.62*	.03
4. Implicit violation of expectation	.32	.59*	.24	–	.35	.55*	-.02
5. Sentence comprehension	-.10	.00	.16	-.08	–	.35	.11
6. Reading comprehension	.07	.09	.13	.17	.06	–	-.23
7. Word fluency	-.06	.03	-.17	-.12	-.05	-.10	–

* $p < .01$ (two-tailed)

Table 5

Fixed-Order Hierarchical Multiple Regression Analyses with Uses of But as Dependent Variables, Age and Word Fluency as Controls, and Sentence and Text Comprehension and the Age X Text Comprehension Interaction as Predictors

	R^2	ΔR^2	B	SE B	β	
DV: Explicit Semantic Opposition						
Step 1	.04	.04				
Step 2	.04	.00				
Step 3	.06	.02				
Step 4	.18	.12**				
Step 5	.24	.06*				
			Age	0.19	0.07	.39*
			Word Fluency	0.05	0.04	.20
			Sentence Comprehension	0.01	0.20	.00
			Text Comprehension	1.01	0.26	.59**
			Age X Text Comprehension	-0.89	0.39	-.33*
DV: Implicit Semantic Opposition						
Step 1	.18	.18**				
Step 2	.18	.00				
Step 3	.24	.06*				

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Step 4	.37	.13**		
Step 5	.44	.07**		
Age			0.29	0.07 .54**
Word Fluency			0.04	0.04 .13
Sentence Comprehension			0.03	0.02 .13
Text Comprehension			1.22	0.26 .61**
Age X Text Comprehension			-1.10	0.39 -.35**

 DV: Explicit Violation of Expectation

Step 1	.17	.17**		
Step 2	.17	.00		
Step 3	.27	.10**		
Step 4	.42	.15**		
Step 5	.52	.10**		
Age			0.20	0.05 .54**
Word Fluency			0.03	0.02 .16
Sentence Comprehension			0.03	0.01 .19*
Text Comprehension			0.92	0.16 .69**
Age X Text Comprehension			-0.88	0.24 -.42**

 DV: Implicit Violation of Expectation

Step 1	.16	.16**		
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Step 2	.16	.00		
Step 3	.19	.03		
Step 4	.32	.13*		
Step 5	.37	.05*		
Age			0.21	0.06 .50**
Word Fluency			0.02	0.03 .09
Sentence Comprehension			0.01	0.02 .07
Text Comprehension			0.93	0.22 .58**
Age X Text Comprehension			-0.76	0.33 -.30*

DV = Dependent variable

* $p < .05$; ** $p < .01$

Table 6

Mean Proportion of Insertions with 'and' for the Cloze Task (SD in Brackets)

Produced by Adults

Explicit semantic opposition	.50 (.21)
Implicit semantic opposition	.19 (.25)
Explicit violation of expectation	.10 (.15)
Implicit violation of expectation	.06 (.11)

Appendix A

Setting and Categories of the Episode from Story 1, Examples of the Four Uses of but (in Bold), and Words Deleted in the Close-task (Underlined) and Options Provided.

Setting

C'era una volta un pianoforte che si era innamorato di una bellissima stella. Ogni sera, quando la stella appariva nel cielo, lui suonava delle musiche dolcissime per lei.

“Once upon a time there was a piano who fell in love with a beautiful star. Every night when she appeared in the sky he played sweet music for her.”

Categories of the Episode

Initiating Event

Implicit Violation of Expectation

*Di solito suonava molto bene **ma** una sera sbagliò una nota (11 words).*

“Cosa fai, sciocco!” gli disse la stella.

“Usually, he played very well **but** one evening he played the wrong note”.

““What are you doing silly piano!” the star said to him.”

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Explicit Violation of Expectation

*Il Pianoforte chiese scusa alla stella **ma** lei non lo perdonò (11 words).*

“The piano said to the star that he was sorry **but** she did not forgive him.”

Internal Response

Implicit Violation of Expectation

*Il pianoforte si mise a piangere **ma** lei era troppo cattiva (11 words).*

“The piano started crying **but** she was too bad.”

Explicit Semantic Opposition

*Allora il pianoforte provò a suonare delle musiche belle **ma** facili (11 words).*

“Then the piano decided to play beautiful **but** easy music”

Attempt

Implicit Semantic Opposition

*Il pianoforte suonava con attenzione per non sbagliare **ma** si ruppe un tasto (13 words).*

‘Come sono sfortunato!’ disse il pianoforte.

“The piano was playing carefully in order not to make mistakes **but** a key broke.

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“I am so unlucky!” said the piano.”

Explicit Violation of Expectation

*Poi provò anche a sistemare il tasto **ma** non ci riuscì*

(11 words).

“Then he also tried to fix the key **but** he was not able to do so”

Consequence

Implicit Semantic Opposition

*Il Pianoforte era triste **ma** arrivò una fata che disse:*

“ti aiuterò” (12 words).

“The piano was sad **but** then a fairy appeared who said to him: “I will help you””

Explicit Semantic Opposition

*Lei disse alla stella che il pianoforte era bravo **ma** molto sfortunato e lo doveva perdonare (16 words).*

“She told the star that the piano was good **but** very unlucky and that she should forgive him.”

Conclusion

La stella si pentì di essere stata così cattiva con il pianoforte. Fecero la pace ed il pianoforte continuò a suonare per lei tutte le sere.

“The star regretted being so bad to the piano. She

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made peace with the piano who then played music for
her every evening”

 Options

Deleted target words from the text	<i>Stella</i> (star); <i>suonava</i> (played); <i>ma</i> (but); <i>pianoforte</i> (piano); <i>il</i> (the); <i>musiche</i> (music); <i>non</i> (not); <i>sistemare</i> (fix); <i>perdonare</i> (forgive); <i>per</i> (for)
Non target words semantically similar	<i>violino</i> (violin); <i>cantava</i> (sang); <i>e</i> (and); <i>luna</i> (moon); <i>un</i> (the); <i>canzone</i> (song); <i>no</i> (no); <i>mettere</i> (put); <i>aiutare</i> (help), <i>con</i> (with)

Appendix B

Examples of Comprehension Questions and Answers from Story 1.

Literal question	<i>Chi ha aiutato il pianoforte a fare pace con la stella?</i>
	Who helped the piano make peace with the star?
Answers to literal question	<i>Una fata/fatina.</i>
	“A fair”.
Inferential question	<i>Perché la stella era arrabbiata con il pianoforte?</i>
	Why did the star get angry with the piano?
Answers to inferential question	<i>Perché (il piano) aveva suonato male;</i>
	<i>perché (il piano) aveva sbagliato nota; perché (il</i>
	<i>piano) aveva suonato il tasto sbagliato.</i>
	“Because the piano did not play well; Because the
	piano played an incorrect note; Because the piano
	played an incorrect key”
